UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
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FILE COPY

REPLY TO THE ATTENTION OF:

January 11, 1993

Mr. Jim Langseth
Barr Engineering Co.
8300 Norman Center Dr.
Suite 300
Minneapolis, Mn. 55437

Re: Waukegan Coke Plant Superfund Site

Dear Mr. Langseth:

The USEPA has completed the review of the Phase I Ground Water Modeling done for the Waukegan Manufactured Gas and Coke Plant Site as outlined in the "Proposed Modeling for RI/FS" Technical Memorandum (July 1, 1991) and the Phase I RI/FS Technical Memorandum (August 1992). The following comments are provided and shall be incorporated and/or addressed prior to finalization of these documents.

1. According to the Phase I report, the purposes of the preliminary modeling done in phase I was threefold: to provide an evaluation of long term groundwater flow patterns, to provide guidance in locating additional monitoring wells, and to design the phase II pumping test. The main text of the report gave very little discussion of the results of the modeling.

   For example, there is no discussion of the groundwater flow patterns simulated by the model (i.e. appendix Figure I-3); no discussion of how the simulated potentiometric map differs from water levels measured (Figures 2.2-5 through 2.2-8); no discussion of how the RI proposes to investigate to resolve the differences; and no discussion of what the significance to the site would be if the simulated flow patterns are correct. These subjects need to be addressed.

   While there is some discussion of the need for off-site water level measurements to improve the confidence of the modeling, there is no discussion relating the specific proposed monitoring well locations to the results of the groundwater

modeling. While there is no requirement that only a groundwater model be used to determine well placements, to state as an objective that modeling will provide guidance in locating wells and then have no discussion of what impact the modeling results had on the choice of well locations is inappropriate.

There is no discussion of how the groundwater model was used to design the pumping test. How was the pumping well selected? Were several different locations modeled to ensure that the selected pump well location is an optimal location? Several different pumping well locations and different pumpage rates should be simulated to determine the appropriate locations and proposed pumpage (though final pumpage rate would be decided in the field after a step-drawdown test of the pumping well).

The report states (page 68, fourth paragraph) that the proposed pumping test design was simulated by the groundwater flow model. Nothing in the RI indicated how this was done. The modeling presented in Appendix I appears to be done only as a steady state simulation. The 24 hour pump test is a transient event; how is it simulated? The report asserts that results of the modeling predicted meaningful drawdowns at specific wells. No map is given showing the simulated potentiometric surface that collaborates these assertions.

2. A number of assumptions have been made in the conceptual model of the site. Many are unstated, unexplained, or unsubstantiated.

It was stated that the aquifer at the site was assumed to have a constant hydraulic conductivity beneath and in the vicinity of the site. This assumption was made because "significant inhomogeneities in lithology and hydraulic conductivity were not observed in soil borings and slug tests" (Appendix I, page I-1). While the slug tests do reveal relatively consistent hydraulic conductivity values, the cross sections and boring logs reveal silty sand units. No wells were screened in the silty sand units and no slug tests done; how was the significance of these inhomogeneities evaluated and deemed insignificant?

A hydraulic conductivity off-site was assumed to be 20 feet/day. Upon what is this assumption based? Some substantiation of this assumption should be given.

The infiltration rate used in the model is said to " represent the infiltration rate that was necessary to achieve calibration". While the appendix asserts that the value may be considered a reasonable value, no justification has been given. Proper modeling protocol would establish viable values or range of values for a parameter (based on site specific data or appropriate documented regional information); calibration would only result in parameter adjustments within this range. In the case of this modeling effort, the explanation seems to indicate that calibration may have decided the values of parameters entirely.

Apparently the modeling was done steady state. There is no discussion of the assumption to model steady state conditions instead of transient. Considerable justification is needed to substantiate an assumption of a steady state flow system given the complex surface water-ground water interactions (refer to previous Canonie and USEPA documents). The RI/FS includes water levels measured over only 2 months of time (April and May 1992). During this time there is a clear trend of decreasing water levels (up to 1 foot of change)which indicates a system that is in steady state.

The simulated groundwater elevations were compared to the May 7, 1992 water levels. Why was this particular round used? If the model is a steady state simulation, water levels that represent average conditions are being modeled and should be compared to average values during calibration.

3. No explanation has been given on how parameters were adjusted during calibration to ensure that the resulting calibrated model is optimal. Was an automated calibration process used or trial-and-error? What was the termination criteria?

   The amount of error in the calibration seems high. Two absolute values residuals (difference between measured and calculated water levels) out of only 9 calibration points are greater than 0.4 feet; the range of simulated water levels is less than 2.0 feet. The Appendix compares the value of the residuals (as the error of the calibration) to the error in the water level measurements. In this case the error in the water level measurements is considered to include the variability in the changing water levels. Since there is such a large change in water levels through time, the resulting observation error would seem large. This error in the observed water levels is artificial and reflects the lack of knowledge about transient effects in the ground water flow system.

4. In discussing the large calibration error located at piezometer P-103, the report hypothesizes (page I-3 of the

Appendix) that the simulated recharge rate at this point may be too high. While the recharge rate seems to be an unknown (assumed based on unspecified reasons), it is not clear how the recharge rate would be too high at P-103 and the same recharge rate not be similarly high at P-104 if the site has no significant inhomogeneities (as is asserted).

5. There is no discussion (either in the report or in the original Proposed Modeling document on why SLAEM is the modeling method being used. Justification for the decision is required.

6. There is no discussion of uncertainty analysis. The level of error associated with the calibration indicates that there is a great deal of uncertainty in the resulting model. Clearly there are data gaps: a longer record of water levels is needed to determine average water levels; water levels are needed at more locations. Simplifying assumptions and assumptions where site specific data is not available have been made. The sensitivity of the model results to these data gaps and assumptions should be discussed.

7. Table I-3 of the Appendix would seem to need further explanation. Apparently the levels represent multiples of the observed groundwater level error. This should be stated in the legend of the table or in the text.

8. Figure I-3 of the Appendix omits P-102.

9. The report does not mention, in the Phase II Workplan, any plans for doing simulations using a contaminant transport model. All references are to "the hydrogeologic model"; the discussion seems to be limited to issues relevant to a groundwater flow model. If remedial measures are to be simulated, simulations of contaminant levels would be needed. The Proposed Modeling Memorandum briefly outlines plans to do contaminant transport simulation modeling. If this work is to be done in phase II the phase II workplan should delineate it.

   The Proposed Modeling Memorandum indicates that transport modeling may be done either with SLAEM or with another program, MYGRIT. It should be made clear under what circumstance each would be used (or if both). The Proposed Modeling Memorandum does not mention calibration; standard modeling protocol would have the transport model calibrated. If the transport model is not calibrated, the results are subject to a great deal of uncertainty.

The modeling proposed for phase II has as its objective the examination of proposed remedial alternatives. Additionally, the model may be determining surface water loadings. Such objectives

requires considerably more certainty in the modeling to be done during phase II.

The largest data gap currently relates to the potentially transient nature of groundwater flow at the site. Considering the large changes documented in the water levels measured over a 2 month period, more frequent water levels than quarterly (monthly at least) are needed. Available off-site wells (such as OMC wells north of the site) should be included in all water level rounds.

The simulated model shows the site to be located on a groundwater divide with the potential of groundwater flow in all directions. Of particular concern is the flow downgradient of proposed new wells 9S and 9D. If the simulated flow map is correct, groundwater (potentially contaminated) may be flowing east toward the beach. In addition to the proposed additional monitoring wells, which will fill some areas of data gaps, water table levels east of the site (on the beach) would also improve the certainty of the model. Temporary well points could be installed, surveyed, developed, and allowed to remain overnight to recover (recovery should be rapid) and then the water levels measured.

With the additional water level data (more measurement locations measured over a longer span of time) and the improved conceptual model (as proposed in Section 3.3.5 of the RI) it should be possible to substantially improve the calibration the groundwater flow model. Without addressing the aforementioned comments, it will not be acceptable to the Agency to use the model to simulate remedial alternatives.

If you have any questions about this review or would like further clarification of these comments, please call me at your earliest convenience. I can be reached by telephone at (312) 353-6316.

Sincerely,

William J. Bolen
USEPA Project Manager

cc: T. Fitzgerald
L. Vanderpool
R. Herseman